

# NEMATOMORPHA

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Almost every year several specimens of long brown worms (class:Nematomorpha) are submitted to the nematology bureau for identification. Specimens have been collected from house floors, bathtubs, swimming pools, ponds, and also have arrived inside insect hosts. In 1980, a specimen was submitted by a medical doctor from an extremely distraught female patient who was convinced she was infected with the worm. Collectors are usually concerned with the status of this worm and wish to know what it is and what its functions are.

This circular will attempt to answer these questions.

HISTORY: Nematomorpha worms were first noted in the 14th and 15th centuries. Carolus Linnaeus, 1758, first used the term Gordius as a generic name due to the resemblance of the worms to the knot tied by Gordius, King of Phrygia. They have

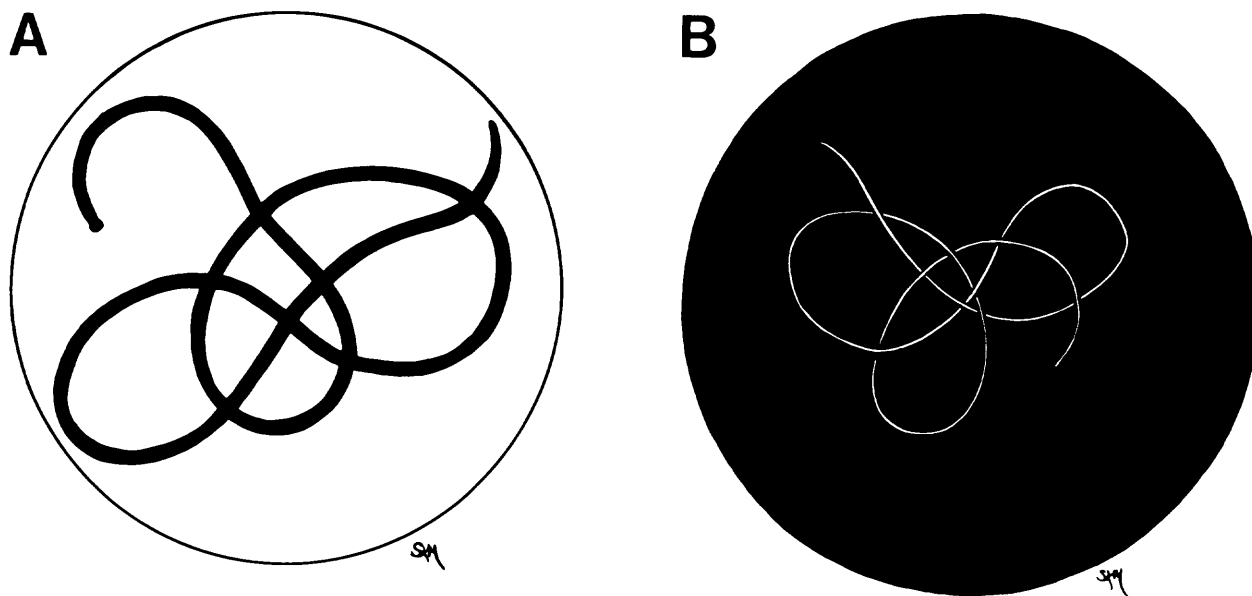


Fig. 1. Hairworm and nematode compared. A. Hairworm; B. Mermithid (Nematode). In the free-living stage the body of (A) is dark, while (B) is white.

since been called "gordian worms" and hairworms. They are also called "horse-hair worms" due to their resemblance to horse hairs and their occurrence in horse-watering troughs early in the 19th century. It was believed, erroneously,

by some that the hairworms were horse hairs that had come to life.

**CHARACTERIZATION:** Adult hairworms (Fig. 1-A) are from 10-90 cm long by 2.5-3 mm wide. They range in color from yellowish grey (rare) to light amber to dark brown. Males are smaller than females. Both extremities are bluntly rounded.

The unpigmented anterior end (calotte) contains a mouth and is set off by a pigmented collar. The tail may be simple, rounded, or may have two (Fig. 2-A, B) or three lobes. The cloaca opening lies just above the lobes (Fig. 2-B). The body has a rough texture due to minute bristles on the surface. Hairworms lack a functional intestine, lateral chords, and an excretory system, all of which nematodes have. Nematodes can be separated visually from hairworms by their white color (Fig. 1-B) and by their tapering at both extremities.

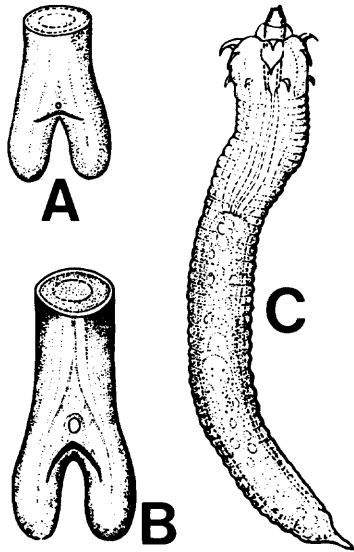


Fig. 2. A, B. Male tails. C. Larva with extruded proboscis. (after Thorne)

**ECONOMIC IMPORTANCE:** Many kinds of insects are parasitized; however, the value of hairworms as biological control agents is dependent on the economic importance of the host parasitized and the total effect on the host population. Gerald Thorne found 25-99% of several populations of Mormon crickets (*Anabrus simplex* Halderman) infected with the hairworm (*Gordius robustus* Leidy) (Fig. 3). He also noted infected crickets rarely lay eggs. Thorne stated that hairworms could be economically important parasites of mormon crickets if breeding grounds favoring the parasite were present.

**GEOGRAPHIC DISTRIBUTION:** Hairworms are distributed worldwide in almost every conceivable aquatic habitat in both temperate and tropical zones.

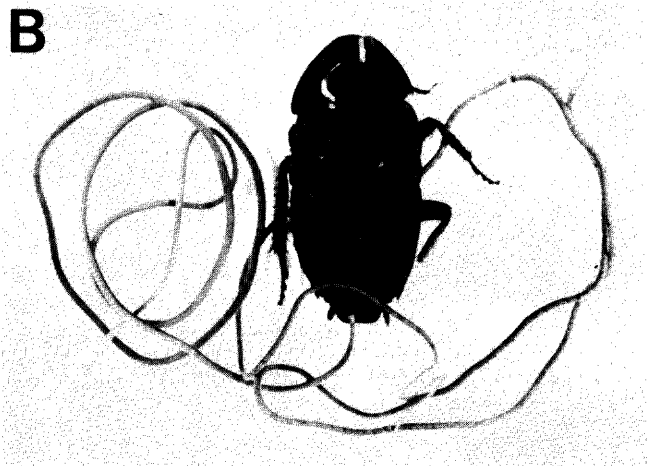
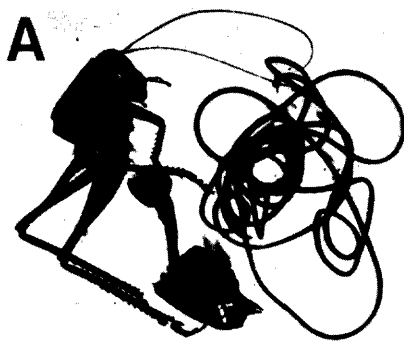


Fig. 3. A Mormon cricket parasitized by a hairworm (after Thorne); B. Woods roach with emerged hairworm.

**HOSTS:** Hairworms show little host specificity. They occur in a wide variety of insects in the orders Coleoptera, Dermaptera, Diptera, Hemiptera, Hymenoptera, Neuroptera, Orthoptera, and Trichoptera. Specimens have been received in the laboratory from German cockroach (Blatella germanica) L., and Florida woods roach (Eurycotis floridana (Walker)) (Fig. 3-B). Millipedes, centipedes, spiders, leeches, and some members of the crustacea have also served as hairworm hosts. In rare cases the worms have been detected internally in man, and in one case they were found encysted in the orbit of a man's eye.

**HABITAT:** Nematomorphs inhabit both running and standing water of ponds, marshes, lakes, and streams. They prefer shallow water 2-25 cm deep but are also found on the shore just above the water's edge. One species was described from a cave. In streams with rapids, gordiads tend to congregate near the banks just below the rapids.

**LIFE HISTORY AND DEVELOPMENT:** Hairworms are parasitic as juveniles and free-living in the adult stage. Adults do not feed.

Gordius robustus emerges from its grasshopper host from September to October and enters water, becoming free-swimming. In November and December, adults accumulate around grass and grass roots just below the water level. In the spring, males and females gather in large tangled masses and mating occurs. Eggs are deposited from late April until early June, either in large gluey masses or in long gelatinous strings (Fig. 4) which may contain over a million ova. Males die after copulation; females perish after egg deposition. Egg incubation lasts 15-80 days. Larvae escape from eggs by rupturing the egg membrane with an armored proboscis. Larvae migrate to aquatic plants where they either secrete mucus and encyst, in which case ingestion by a host insect feeding on the plant is necessary for completion of the life cycle or they burrow into a host or are swallowed unencysted by the host. Once inside the host they bore through the wall of the intestine and enter the hemocoel where they obtain nutrition and develop. Larvae absorb food through their body wall. Growth and molting follow after which the larvae metamorphose to the adult stage. If the host, such as a mosquito, is too small to support development, the worm will encyst. Development is completed if a larger invertebrate, such as a praying mantis, ingests the small insect with its encysted larva. Adult hairworms emerge when the host insect closely approaches a body of water. Inside its host the body is milky white to light tan. After emergence the body darkens from brown to almost black. Hairworms can survive about 6 months in fresh water. Hibernation also occurs in moist soil.

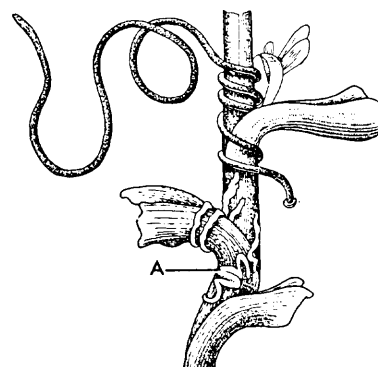


Fig. 4. A hairworm laying eggs (A) on the foliage of an aquatic plant (after von Linstow).

**SURVEY AND DETECTION:** Hairworms occur in bodies of water singly but usually as tangled masses of amber to dark brown, slender, slowly undulating worms. In household waters they usually occur singly in standing water, in sinks, bathtubs,

or commodes where they have emerged from a passing invertebrate. In invertebrate hosts they appear as one to several tightly coiled brown hairlike worms.

#### SELECTED REFERENCES\*

1. Filipjev, I. N., and J. H. Schuurmans Stekhoven, Jr. 1941. A manual of agricultural helminthology. E. J. Brill Leiden, Netherlands. 878p.
2. Hyman, L. H. 1951. The Invertebrates: Acanthocophala, Aschelminthes, and Entoprocta, The Pseudocoelomate Bilateria. McGraw Hill, N. Y. 572p.
3. May, H. G. 1915. Contributions to the life histories of Gordius robustus Leidy and Paragordius varius (Leidy). Ill. Biol. Monographs V:121-238.
4. Pennak, R. W. 1953. Fresh-water invertebrates of the United States. Ronald Press Co., N. Y. 769p.
5. Shephard, M. R. N. 1974. Arthropods as final hosts of nematodes and nematomorphs. An annotated bibliography 1900-1972. Tech. Communication, Commonwealth Inst. Helminthol., St. Albans, No. 45, 248p.
6. Thorne, G. 1940. The hairworm Gordius robustus Leidy as a parasite of the Mormon cricket Anabrus simplex Haldeman. J. Wash. Acad. Sci. 30:219-231.

\*A total of 61 references were consulted which are on file in the DPI Nematology Bureau subject file under Nematomorpha.